

U.S. Patent Application Serial No. 10/657,192
Response filed July 12, 2006
Reply to OA dated March 13, 2006

REMARKS

Claims 11 - 13, 15 and 16 are pending in this patent application, claims 13 and 15 being independent claims.

Claims 1 - 10 and 14 are canceled without prejudice or disclaimer. Claims 11 and 12 are amended, and claims 15 and 16 are added in order to more particularly point out, and distinctly claim the subject matter to which the applicants regard as their invention. It is believed that this Amendment is fully responsive to the Office Action dated March 13, 2006.

The applicants have amended the title of the invention (so as to read: VACUUM APPARATUS AND VACUUM PROCESSING METHOD) in order to provide a more descriptive title in this application for the applicants' invention. The applicants respectfully request that the title of the invention, as submitted herewith, be approved by the Examiner.

As to the outstanding rejections, at the outset, the applicants thank the Examiner for now withdrawn his previous reliance on Collins (U.S. Patent No. 6,252,354).

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However, the Examiner now relies on new references setting forth the following obviousness rejections:

(1) claim 13 stands rejected under 35 USC §102(b) as being anticipated by Ohno (U.S. Patent No. 4,851,668);

(2) claims 1 - 10 and 12 stand rejected under 35 USC §103(a) based on Yazurihara (U.S. Patent No. 6,211,749) in view of Barnes (U.S. Patent No. 5,793,162); and

(3) claim 11 stands rejected under 35 USC §103(a) based on Yazurihara in view of Barnes, and further in view of Ahonen (U.S. Patent No. 5,308,461).

The applicants respectfully request reconsideration of these rejections.

The applicants' claimed invention, as recited in independent claim 13, is directed to a method of vacuum processing, the claimed method comprising the steps of: ionizing gas supplied to an ionization chamber by applying an alternating current field to the gas to generate plasma; applying a positive voltage to a first electrode disposed in the vicinity of an opening of the ionization chamber; applying negative voltage to a second electrode disposed farther from the ionization chamber than the first electrode; and releasing positive ions into a vacuum chamber, the positive ions being extracted from the plasma by an electric field formed by the first and second electrodes. The claimed method, as recited in claim 13, further includes the steps of releasing electrons from an electron generator into the vacuum chamber in order to neutralize a flow of the positive ions by

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applying the electrons; and irradiating the neutralized positive ions to a target object disposed inside the vacuum chamber. When plasma is regenerated due to disappearance of the plasma, the electrons emitted from the electron generator are attracted into the ionization chamber by applying a voltage higher than that of the vacuum chamber to the second electrode.

Significant features of the applicants' claimed method of vacuum processing, as set forth in claim 13, include the features such that when plasma is regenerated due to disappearance of the plasma, the electrons emitted from the electron generator are attracted into the ionization chamber by applying a voltage higher than that of the vacuum chamber to the second electrode.

In the Examiner's reliance on Ohno, the Examiner specifically relies on line 42, column 2 through line 64, column 3 of this patent. What is significant in this portion of Ohno is the process in which the voltages applied to a first grid 7 and a second grid 8 (as illustrated in Figure 1 thereof), and the input current of the electron beam generator 15 are controlled based on the relationship illustrated in Ohno's Figures 2A through 2E. However, in Ohno, there is no description or teaching that electrons generated by the electron beam generator 15 are attracted into the ionization chamber when plasma is regenerated.

In view of the above, the applicants submit that not all of the claimed features of the applicants' method of vacuum processing, as set forth in claim 12, are found in exactly the same

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situation and united in the same way to perform the identical function in Ohno's process; thus, there can be no anticipation of the applicants' claimed invention, as set forth in claim 13, based on the teachings of Ohno.

Accordingly, the withdrawal of the outstanding anticipation rejection under 35 USC §102(b) based on Ohno (U.S. Patent No. 4,851,668) is in order, and is therefore respectfully solicited.

As to the outstanding rejections of claims 1 - 10, these claims have been canceled without prejudice or disclaimer. Thus, the outstanding rejection of claims 1 - 10 is now moot. As to claims 11 and 12, these claims have been amended so as to now depend on added claim 15.

The applicants' claimed invention, as now set forth in claim 15, is directed to a vacuum apparatus, which includes a vacuum chamber; an RF source; a plasma generator; a detecting device for detecting disappearance of plasma; and first and second variable inductance elements. As now set forth in claim 15, the first variable inductance element comprises a first main winding, and a first control winding magnetically coupled to the first main winding. As further recited in claim 15, the second variable inductance element includes a second main winding, and a second control winding magnetically coupled to the first main winding. The first and second main windings are controlled based on a magnitude of direct current flowing through the first and second control windings respectively; and the RF source is connected to the plasma generator via the first main

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winding and the RF source is connected to ground voltage via the second main winding. Furthermore, the claimed plasma generator generates plasma by RF voltage outputted from the RF source, and when the disappearance of plasma is detected by the detecting device, the direct current flowing through the second control winding is decreased in order to increase the inductance of the second main winding larger than its inductance when plasma is maintained, and then, the RF voltage outputted to the plasma generator is increased.

Significant structural arrangements of the applicants' claimed vacuum apparatus, as now set forth in claim 15, are such that when the disappearance of plasma is detected by the detecting device, the direct current flowing through the second control winding is decreased in order to increase the inductance of the second main winding larger than its inductance when plasma is maintained, and then, the RF voltage outputted to the plasma generator is increased.

In Yuzurihara, a matching box having variable inductance element is described. In the secondary reference of Barnes, such reference employs a matching network 16 having two series arms respectively including variable series capacitors 18, 20, and a fixed shunt capacitor 24, connected between a common terminal of capacitors 18, 20 and ground.

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However, there is no teaching in Yuzurihara and Barnes, singly or in combination, of the claimed structural arrangement, now set forth in claim 15, such that when the disappearance of plasma is detected by the detecting device, the direct current flowing through the second control winding is decreased in order to increase the inductance of the second main winding larger than its inductance when plasma is maintained, and then, the RF voltage outputted to the claimed plasma generator is increased. If the matching box of Yuzurihara is merely connected to the vacuum chamber, it can control the variable inductance element to match impedance. However, it is not possible to modify such Yazurihara apparatus to increase inductance of the main winding so as to increase RF voltage applied to the plasma generator when plasma disappears.

Thus, even if *arguendo* the teachings of Yuzurihara and Barnes can be combined in the manner suggested by the Examiner, such combined teachings would still fall far short in fully meeting the applicants' claimed invention, as now set forth in claim 15 from which claim 12 now depends.

In view of the above, the withdrawal of the outstanding rejection under 35 USC §103(a) based on Yazurihara (U.S. Patent No. 6,211,749) in view of Barnes (U.S. Patent No. 5,793,162) is in order, and is therefore respectfully solicited.

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As to other secondary reference, Ahonen, this reference is specifically relied upon for teaching "a plasma generator . . . having an ionization chamber 200 with a coil 230 wound around the ionization chamber 200" (see, lines 18 and 19, page 7 of the outstanding Action). However, such teaching does not supplement the above-discussed deficiencies or drawbacks in the teachings of Yuzurihara and Barnes in failing to fully meet the applicants' claimed invention, as now recited in claim 15 from which claim 11 depends. That is, the suggested combination of references does not teach the claimed structural arrangement such that when the disappearance of plasma is detected by the detecting device, the direct current flowing through the second control winding is decreased in order to increase the inductance of the second main winding larger than its inductance when plasma is maintained, and then, the RF voltage outputted to the plasma generator is increased, as recited in claim 15 from which claim 11 depends. Thus, even if *arguendo* the teachings of the cited references can be combined in the manner suggested by the Examiner, such combined teachings would still fall far short in fully meeting the claimed invention. As such, a person of ordinary skill in the art would not have found the applicants' claimed invention obvious.

In view of the above, the withdrawal of the outstanding rejection under 35 USC §103(a) based on Yazurihara in view of Barnes, and further in view of Ahonen (U.S. Patent No. 5,308,461) is in order, and is therefore respectfully solicited.

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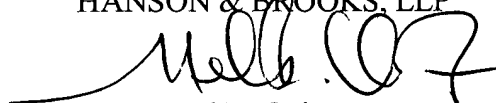
In view of the aforementioned amendments and accompanying remarks, claims, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper to Deposit Account No. 01-2340.

Respectfully submitted,

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